Transmittal Letter to the United States Designated/Elected Office (DO/EO/US)

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Docket No. : **HM-469PCT**
U.S. Application No :
International Application No. : **PCT/EP00/07961**
International Filing Date : **August 16, 2000**
Priority Dates Claimed : **August 20, 1999**
Title of Invention : **STRIP CASTING MACHINE COMPRISING TWO CASTING ROLLERS**
Applicant(s) for (DO/EO/US) : **Hans Streubel, Heinrich Marti and Jaques Barbè**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. X This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ___ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. X This express request to begin national examination procedures 35 U.S.C. 371 (f) at any time rather than delay examination until the expiration of the applicable time limit set forth in 35 U.S.C 371(b) and PCT Articles 22 and 39(1)
4. ___ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date
5. X A copy of the International Application as filed [35 U.S C. 371(c)(2)],
   a) X is transmitted herewith (required only if not transmitted by the International Bureau).
   b) ___ has been transmitted by the international Bureau.
   c) ___ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. X A translation of the International Application into English [35 U.S.C.371(c)(2)]
7. ___ Amendments to the claims of the International Application under PCT Article 19 [35 U.S C 371(c)(3)].
   a) ___ are transmitted herewith (required only if not transmitted by the International Bureau)
   b) ___ have been transmitted by the International Bureau.
   c) ___ have not been made; however, the time limit for making such amendments has **NOT** expired
   d) ___ have not been made and will not be made.
8. ___ A translation of the amendments to the claims under PCT Article 19 [35 U.S.C 371(c)(3)]
9. X An oath or declaration of the inventor(s) [35 U S.C 371(c)(4)] **UNSIGNED**
10. ___ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 [35 U S C 371(c)(5)]

Items 11. to 16. below concern other document(s) or information included:

11. X An Information Disclosure Statement under 37 C F.R 1.97 and 198
12. ___ An Assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3 31 is included
13. X A **FIRST** preliminary amendment
    ___ A **SECOND** or **SUBSEQUENT** preliminary amendment
14. ___ A substitute specification
15. ___ A change of power of attorney and/or address letter
16. X (other items or information) **Two sheets of drawings, PTO-1449 w/ 4 references and International Search Report**

EXPRESS MAIL No.. **EL 862 851 631 US** Deposited: **February 15, 2002**

I hereby certify that this correspondence is being deposited with the United States Postal Service Express mail under 37 CFR 1 10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, DC 20231

Friedrich Kueffner

February 15, 2002
Date

17. X The following fees are submitted

	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE [37 CFR 1.492(a)(1)-(5)]:		
X Search Report has been prepared by the EPO or JPO. . . . . $ 890.00		
___ International preliminary examination fee paid to USPTO [37 CFR 1.482]: . . . . . $ 710.00		
___ No International preliminary examination fee paid to USPTO [37 CFR 1.482] but International search fee paid to USPTO [37CFR 1 445(a)(2): . . . . . $ 740.00		
___ Neither International preliminary examination fee [37 CFR 1.482] nor International search fee [37 CFR 1 445(a)(2)] paid to USPTO . . . . . $ 1040.00		
___ International preliminary examination fee paid to USPTO [37 CFR 1 482] and all claims satisfied provisions of PCT Article 33 (2) to (4) . . . . $ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT:	$ 890.00	
Surcharge of $ 130.00 for furnishing the oath or declaration later than ___20 ___30 months from the earliest claimed priority date [37 CFR 1.492(e)]	$	
Claims filed: Total Claims 22 -20= 2 x $ 18.=	$	
Indep. Claims 1 - 3= x $ 84.=	$	
Multiple Dependent Claims (if applicable) + $ 280.=	$ 36.00	
TOTAL OF ABOVE CALCULATIONS:	$ 926.00	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity Statement must be filed also. [Note 37 CFR 1.9,1 27, 1 28] (divided by 2)		
SUBTOTAL:	$ 926.00	
Processing fee of $ 130 00 for furnishing the English Translation later than ___20 ___30 months from the earliest claimed priority date [37 CFR 1.492(f)]	$	
TOTAL NATIONAL FEE:	$ 926.00	
Fee for recording the enclosed assignment [37 CFR 1.21(h)] The assignment must be accompanied by an appropriate cover sheet [37 CFR 3 28,3.31]. $ 40.00 per property	$	
TOTAL FEES ENCLOSED:	$ 926.00	
AMOUNT TO BE REFUNDED:	Refunded	$
AMOUNT TO BE CHARGED:	Charged	$

a) X A check in the amount of **$ 926.00** to cover the above fees is enclosed

b) _ Please charge my Deposit Account No 11-1835 in the amount of $ to cover the above fees
A duplicate copy of this sheet is enclosed.

c) X The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **11-1835**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 36 CFR 1 494 or 1.495 has not been met, a petition to revive [37 CFR 1.137(a) or (b)] must be filed and granted to restore the application to pending status

SEND ALL CORRESPONDENCE TO: Friedrich Kueffner
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signature

29,482
Reg. No.

February 15, 2002
Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

HM-469PCT

Applicant(s)	:	Hans Streubel, et al
Serial No.	:	NOT YET KNOWN (PCT/EP00/07961)
Int. Filed	:	August 16, 2000
For	:	STRIP CASTING MACHINE COMPRISING TWO CASTING ROLLERS

Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

S I R:

In advance of the first office action, please amend the claims as follows:

IN THE CLAIMS

Replace current claims 1 - 22 by the enclosed amended claims 1 - 22. A marked-up version of amended claims 1 - 22 is also enclosed.

REMARKS

Claims 1 - 22 are in the application.

As a result of the foregoing amendment, the claims have been amended to remove improper multiple dependencies.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 11-1835.

Respectfully submitted,

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February 15, 2002
FK:ml
ENCLS:
Amended Claims;
Marked-Up Version.

EXPRESS MAIL No.: **EL 862 851 631 US** Deposited: **February 15, 2002**

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Friedrich Kueffner

CLEAN VERSION OF AMENDED CLAIMS

1. Strip casting machine comprised of two casting rollers (1, 2, 21) arranged parallel to each other, forming a casting gap (6) delimited on both sides by narrow lateral guides (5), and a stand (3, 23) supporting the casting rollers (1, 2, 21), wherein the casting rollers (1, 2, 21) are provided with cooled roll barrels forming the adjustable casting gap (6), and wherein bearing journals (8, 9) are provided for supporting the casting rollers (1, 2, 21) on the stand (3, 23), wherein the cooled roll barrel is comprised essentially of a cylindrical casing (27), which is supported on a stationary axle (24) fixedly connected to the stand (3, 23), by means of at least one supporting element, in particular, by supporting elements (29, 29') arranged on both sides, or by at least one supporting element (29, 29'), in particular protruding into the casing (27) on both sides.

2. Strip casting machine according to claim 1, wherein one supporting element (29') forms a part of the casing (27) and one supporting element (29) forms a part of the axle (24).

3. Strip casting machine according to claim 1, wherein the supporting elements (29, 29') are concentrical bearing rings connectable to the casing (27).

4. Strip casting machine according to claim 1, wherein the supporting elements (29, 29') form a part of the casing (27).

5. Strip casting machine according to claim 1, wherein a first portion of the length of the supporting elements or the bearing rings (29, 29') projects into the casing and is provided with inlet and outlet bores (32) between the stationary axle (24) and the casing (27) for circulation of a cooling medium, and in that a second portion of the length of the supporting elements or the bearing rings (29, 29') projects from the casing (27) and is provided with bearing elements (31) and drive elements (37) for a rotational movement of the casing (27), provided with the supporting elements, or of the casing (27), fixedly connected to the bearing rings (29, 29'), on the stationary axle (24).

6. Strip casting machine according to claim 1, wherein a crown gear (37) is connected to the bearing ring (29), which is in active connection with a toothing of a stationary drive (36).

7. Strip casting machine according to claim 6, wherein a drive gear (36) is flanged to the stationary axle (24).

8. Strip casting machine according to claim 6, wherein one or several annular torque motors drive the casing (27) by way of the bearing rings (29).

9. Strip casting machine according to claim 1, wherein the bearing rings (29, 29') are preferably provided with radial bores (32) and grooves (33) for feeding the cooling medium from the stationary axle (24) into the casing (27).

10. Strip casting machine according to claim 9, wherein the stationary axle (24) is provided on both sides with axial bores (30') and with radial bores (34) aligned with grooves (33) of the bearing rings (29, 29').

11. Strip casting machine according to claim 1, wherein the casing (27) is provided across its circumference with axially arranged bores (39) for a circulation of a cooling medium.

12. Strip casting machine according to claim 1, wherein engaging keys (28) having a straining ring are provided between the bearing rings (29, 29') and the casing (27).

13. Strip casting machine according to claim 1, wherein the stationary axle (24) is provided with inlet and outlet means (30) for a cooling medium, which simultaneously connect or disconnect inlet and outlet lines for cooling medium in the stand (23) when the casting roller (21) is inserted into or lifted off the stand (23).

14. Strip casting machine according to claim 1, wherein that the stationary axle (24) is provided on both sides of the casing (27) with a stop surface (12, 13) and a support surface (10, 11), respectively, and that stop surfaces and support surfaces are arranged on the stand for inserting the casting rollers from above.

15. Strip casting machine according to claim 14, wherein a locking element (40) for fixedly securing the stationary axle (24) is provided on both sides of the stand (23), respectively.

16. Strip casting machine according to claim 1, wherein an electromagnetic brake (41) for the metal bath between the rollers is arranged between the rotating casing (27) and the stationary axle (24).

17. Strip casting machine according to claim 16, wherein the electromagnetic brake (41) within the casting roller (21) is arranged stationarily on the stationary axle (24).

18. Strip casting machine according to claim 1, wherein the cylindrical casing (27) is supported on the stationary axle (24) by additional bearing rings between the two bearing rings (29, 29').

19. Strip casting machine according to claim 1, wherein the drive (36) of the casting rollers (1, 2, 21) is effected by means of a motor, preferably a brushless annular torque motor, arranged on or at the axle.

20. Strip casting machine according to claim 1, wherein the casing (27) is configured as a single piece or of multiple pieces.

21. Strip casting machine according to claim 20, wherein the connection of the casing pieces (27, 27') is preferably an electron-beam weld joint.

22. Strip casting machine according to claim 1, wherein the casing (27) is built of two or more sleeves of different materials.

MARKED-UP VERSION OF AMENDED CLAIMS

1. Strip casting machine comprised of two casting rollers (1, 2, 21) arranged parallel to each other, forming a casting gap (6) delimited on both sides by narrow lateral guides (5), and a stand (3, 23) supporting the casting rollers (1, 2, 21), wherein the casting rollers (1, 2, 21) are provided with cooled roll barrels forming the adjustable casting gap (6), and wherein bearing journals (8, 9) are provided for supporting the casting rollers (1, 2, 21) on the stand (3, 23),
[characterized in that] wherein
the cooled roll barrel is comprised essentially of a cylindrical casing (27), which is supported on a stationary axle (24) fixedly connected to the stand (3, 23), by means of at least one supporting element, in particular, by supporting elements (29, 29') arranged on both sides, or by at least one supporting element (29, 29'), in particular protruding into the casing (27) on both sides.

2. Strip casting machine according to claim 1,
[characterized in that] wherein
one supporting element (29') forms a part of the casing (27) and one supporting element (29) forms a part of the axle (24).

3. Strip casting machine according to claim 1,
[characterized in that] wherein
the supporting elements (29, 29') are concentrical bearing rings connectable to the casing (27).

4. Strip casting machine according to claim 1,
[characterized in that] wherein
the supporting elements (29, 29') form a part of the casing (27).

5. Strip casting machine according to [at least one of the claims 1 through 4,
characterized in that] claim 1, wherein
a first portion of the length of the supporting elements or the bearing rings (29, 29') projects into the casing and is provided with inlet and outlet bores (32) between the stationary axle (24) and the casing (27) for circulation of a cooling medium, and in that a second portion of the length of the supporting elements or the bearing rings (29, 29') projects from the casing (27) and is provided with bearing elements (31) and drive elements (37) for a rotational movement of the casing (27), provided with the supporting elements, or of the casing (27), fixedly connected to the bearing rings (29, 29'), on the stationary axle (24).

6. Strip casting machine according to [at least one of the claims 1 through 5,
characterized in that] claim 1, wherein
a crown gear (37) is connected to the bearing ring (29), which is in active connection with a toothing of a stationary drive (36).

7. Strip casting machine according to claim 6,
[characterized in that] wherein
a drive gear (36) is flanged to the stationary axle (24).

8. Strip casting machine according to claim 6,
[characterized in that] wherein
one or several annular torque motors drive the casing (27) by way of the bearing rings (29).

9. Strip casting machine according to [at least one of the claims 1 through 8,
characterized in that] claim 1, wherein
the bearing rings (29, 29') are preferably provided with radial bores (32) and grooves (33) for feeding the cooling medium from the stationary axle (24) into the casing (27).

10. Strip casting machine according to claim 9,
[characterized in that] wherein
the stationary axle (24) is provided on both sides with axial bores (30') and with radial bores (34) aligned with grooves (33) of the bearing rings (29, 29').

11. Strip casting machine according to [at least one of the claims 1 through 10,
characterized in that] claim 1, wherein
the casing (27) is provided across its circumference with axially arranged bores (39) for a circulation of a cooling medium.

12. Strip casting machine according to [at least one of the claims 1 through 11,
characterized in that] claim 1, wherein
engaging keys (28) having a straining ring are provided between the bearing rings (29, 29') and the casing (27).

13. Strip casting machine according to [at least one of the claims 1 through 12,
characterized in that] claim 1, wherein
the stationary axle (24) is provided with inlet and outlet means (30) for a cooling medium, which simultaneously connect or

disconnect inlet and outlet lines for cooling medium in the stand (23) when the casting roller (21) is inserted into or lifted off the stand (23).

14. Strip casting machine according to [at least one of the claims 1 through 13,
characterized in that] claim 1, wherein
that the stationary axle (24) is provided on both sides of the casing (27) with a stop surface (12, 13) and a support surface (10, 11), respectively, and that stop surfaces and support surfaces are arranged on the stand for inserting the casting rollers from above.

15. Strip casting machine according to claim 14,
[characterized in that] wherein
a locking element (40) for fixedly securing the stationary axle (24) is provided on both sides of the stand (23), respectively.

16. Strip casting machine according to [at least one of the claims 1 through 15,
characterized in that] claim 1, wherein
an electromagnetic brake (41) for the metal bath between the rollers is arranged between the rotating casing (27) and the stationary axle (24).

17. Strip casting machine according to claim 16,
[characterized in that] wherein
the electromagnetic brake (41) within the casting roller (21) is arranged stationarily on the stationary axle (24).

18. Strip casting machine according to [at least one of the claims 1 through 17,
characterized in that] claim 1, wherein
the cylindrical casing (27) is supported on the stationary axle (24) by additional bearing rings between the two bearing rings (29, 29').

19. Strip casting machine according to [at least one of the claims 1 through 18,
characterized in that] claim 1, wherein
the drive (36) of the casting rollers (1, 2, 21) is effected by means of a motor, preferably a brushless annular torque motor, arranged on or at the axle.

20. Strip casting machine according to [at least one of the claims 1 through 19,
characterized in that] claim 1, wherein
the casing (27) is configured as a single piece or of multiple pieces.

21. Strip casting machine according to claim 20,
[characterized in that] wherein
the connection of the casing pieces (27, 27') is preferably an electron-beam weld joint.

22. Strip casting machine according to [at least one of the claims 1 through 21,
characterized in that] claim 1, wherein
the casing (27) is built of two or more sleeves of different materials.

Translation of WO 01/14085 (PCT/EP00/07961)

Strip Casting Machines With Two Casting Rollers

The invention relates to a strip casting machine, comprised of two casting rollers arranged essentially parallel to each other, according to the preamble of claim 1.

It is well-known to produce by means of strip casting machines continuous strips of liquid melted metal, especially of melted steel. In this connection, the liquid metal is continuously fed to a casting gap defined by driven casting rollers. The liquid metal solidifies in front of and within the casting gap, and an at least partially solidified strip is removed by the casting rollers. This strip may be subjected to further continuous or discontinuous treatment like cooling, reheating, hot or cold rolling, profile transforming, surface treatment, trimming or the like.

It is also well-known in connection with strip casting machines, having two casting rollers arranged essentially parallel to each other, to delimit the casting gap with narrow lateral guides. Such narrow lateral guides can rest against end faces of the casting rollers or can be inserted between casing surfaces or roll barrels of the casting rollers and be arranged to be displaceable, for example, for adjusting the format of the strip. The casting rollers are arranged in a stand and can be displaced or pivoted essentially transversely relative to the longitudinal axis of the casting rollers in order to adjust the strip thickness. For cooling the liquid metals, the casting rollers, in particular, the roll barrels of the casting rollers, are cooled intensively by a cooling medium from the interior and/or from the exterior. Generally, the casting rollers are composed of different materials,

wherein a material of high thermal conductivity is selected for the cooled roll barrels and a high strength steel is selected for bearing journals and roller core. The bearing journals, the roller core, and the roll barrels form a roller unit which can be set into rotation by means of a drive. The drive action is introduced into the bearing journals and transmitted by them onto the roll barrels. This configuration already known from classic rolling mill design or from the classic design of driving rollers for billet or slab continuous casting machines requires space laterally of the casting machine for the drives and thereby impairs the lateral access to the casting gap and to the narrow lateral guides delimiting the casting gap in its length. This known casting roller configuration also affects the configuration of the stand, the space requirement for multi-strand casting machines, the exchange of casting rollers and narrow lateral guides, the protection against oxidation of the liquid metal and of the cast strip, and the activities for operating and maintaining the machine.

It is the object of the invention to configure a strip casting machine which overcomes the aforementioned disadvantages and provides, in particular, an optimum ratio between the width of the machine and the castable strip width, has a simple configuration and allows better accessibility for changing the rollers as well as for positioning and exchanging the narrow lateral guides delimiting the casting gap, and which ensures, by means of its compact configuration, a better protection against oxidation of the metal feed and the cast product.

This object is solved according to the invention by the sum of the features of claim 1.

It is possible with the invention to position the casting roller drive such that the requirements stated in the object can be satisfied. Furthermore, the configuration of the roller can be better adjusted to the requirements of a casting roller in the sense of a cooled casting mold as can be seen from the subsequent description. In addition to the protection against oxidation of the metal feed, a protection against oxidation of the cast product, entailing corresponding quality improvements, is made possible more easily with the strip casting machine according to the invention.

The supporting members, on the one hand, can be a part of the casing, and/or, on the other hand, form a part of the stationary axle. All supporting members can also be a part of the cooled casing of the casting roller such that the casing with the supporting members forms a unitary member and is rotatably supported on the stationary axle. The supporting members are advantageously configured as concentric bearing rings connectable to the casing and supported on the stationary axle.

For example, the drive can engage the casing part of the casting roller directly or indirectly. An advantageous solution is accomplished when a first portion of the length of the bearing rings projects into the casing and is provided with cooling water inlet and outlet bores for cooling water circulation between the stationary axle and the casing. A second portion of the length of the bearing rings projects out of the casing and is provided at one side, at least, with bearing and drive members for a rotating movement of the casing, fixedly connected with the bearing rings, on the stationary axle. A straining ring with engaging keys is provided between the bearing rings and the casing.

The casting roller drive can be configured in many different ways according to the prior art solutions. An advantageous and simple solution results when a crown gear, being in active connection with a toothing of a stationary drive, is connected to the bearing ring. A driving gear, for example, can be flanged to the stationary axle.

As an alternative solution, it is suggested that one or several annular torque motors drive the casing by way of the bearing rings. Particularly advantageous is the drive of the casting rollers by means of a motor, preferably a brushless annular torque motor, arranged on or at the axle.

Various solutions are feasible for the supply and removal of the cooling medium through the stationary axle and the bearing rings relative to the casing of the casting rollers. For an advantageous configuration alternative, it is suggested to provide the bearing rings preferably with radial bores and grooves for feeding the cooling medium from the stationary axle to the casing. With this configuration, the stationary axle can be provided with axial bores on both sides and with radial bores at the end area of the axial bores which radial bores are aligned with the grooves of the bearing rings.

Also, the process of cooling the casing itself can be accomplished according to various prior art solutions for a circulation of the cooling medium. A simple and very cooling-effective solution results when the casing is provided across its circumference with bores for the circulation of a cooling medium, which bores are parallel to the longitudinal axis of the roller, wherein the direction of flow changes from bore to bore. The number of the bores must therefore be even.

In order to shorten the time required for changing the casting rollers, the stationary axle is provided with inlet and outlet means for the cooling medium, which simultaneously connect or disconnect inlet or outlet lines for the cooling medium when the rollers are placed onto or are lifted off the stand, and/or water clamping plates for feeding water and/or multi couplings for grease, energy supply, gas supply, for example, inert gas or air, and control are provided.

A simple and quick positioning and fixation of the casting rollers is accomplished when the stationary axle is provided on both sides of the casing with a stop surface and a support face and when the stand is provided with stop and support surfaces for placing the casting rollers from above. For the fixation of the stationary axle, a swivel arm, for example, can be pivotably connected as a fastening means on both sides of the stand, respectively.

For calming the melted bath within the casting gap, an electromagnetic brake can be arranged between the rotating casing and the stationary axle. A particular advantage with regard to positioning and attaching such an electromagnetic brake is seen in that it can be arranged stationarily on the stationary axis.

The invention will be further explained in the following with the help of configurational embodiments. It is shown in:

Figure 1 a schematic view of a partially illustrated strip casting machine, and

Figure 2 a vertical section of a casting roller,

Figure 3 an enlarged detail of a casting roller with a cooled casing and a direct drive by means of an annular torque motor.

In Fig. 1, two casting rollers 1 and 2, arranged essentially parallel to each other, having cylindrical casings 4 are schematically arranged on a stand 3 which is indicated in a dash-dotted line. A casting gap 6, delimited on both sides of the casting rollers 1 and 2 by narrow lateral guides 5, is indicated by dimension lines. Such a casting gap 6 can measure between 1 - 15 mm, preferable 1.5 - 5 mm. Bearing journals 8, 9 of the casting rollers 1, 2 are configured at their support surfaces 10, 11 to be square-shaped. Stop surfaces 12, 13 of the bearing journals 8, 9 are utilized as roller stops on the stand 3. At least one of the stop surfaces 12, 13 of the bearing journals 8, 9 can be adjusted by means of position-controlled cylinders arranged within the stand 3 and provided for adjusting the desired casting gap. For simplification purposes, a double arrow is shown in Fig. 1 in this regard. Aligning the fixed roller can be accomplished by means of position-controlled cylinders. For this purpose, setting spindles can also be provided or other setting means acting similarly. Toothed wheels for driving the casting rollers 1, 2 are schematically shown with reference numerals 15, 15'. Such strip casting machines can be used for various casting metals, preferably for producing steel band.

Fig. 2 illustrates with reference numeral 21 a casting roller on an enlarged scale compared to Fig. 1. The casting roller 21 is supported on a stand 23 which is only shown partially. A stationary axle 24 penetrating the entire roller 21 is supported with its square ends on the stand 23 across an approximate length 25. The length of a roll barrel of a casting roller 21 is indicated by an arrow head 26. This roll

barrel is essentially comprised of a cylindrical casing 27 fixedly connected to two bearing rings 29, 29' by means of engaging keys 28 having a straining ring. The casing 27 is cooled by a cooling medium, preferably water. The two bearing rings 29, 29' are supported on the axle 24 by sliding bearings, ball bearings, or roller bearings 31. A first portion of the length of the bearing rings 29, 29' protrudes into the casing 27 and is provided with radial inlet and outlet bores 32 for cooling water, which bores open into grooves 33. The grooves 33 are aligned with radial inlet and outlet bores 34, 42 of the stationary axle 24 and of the casing 27. The cooling water is fed from the stand 23 into the bearing rings 29, 29' and into the casing 27 by way of further bore holes 30, 30' within the axle 24.

A second portion of the length of the bearing rings 29, 29' projects out of the casing 27 and the bearing ring 29 is in active connection with a drive, for example, a gear wheel drive 36, for the casting roller 21. The gear wheel drive 36, if desired, can be flanged to the stationary axle 24. It engages a crown gear 37 screwed down on the bearing ring 29. Instead of the illustrated gear wheel drive 36, 37, it is possible, as an alternative solution, to drive the casting roller 21 with one or several annular torque motors.

Cooling the roll barrels of the casting rollers or the cylindrical casings 27 across its circumference can be ensured by a circulation of cooling water through axially arranged bores 39.

Connecting and disconnecting the cooling water inlet or outlet to the casting rollers 21 takes place simultaneously with inserting into or lifting off the roller 21 from the stand 23 or by means of water clamping plates for water and/or multi

couplings for the grease supply, energy supply, for the gas supply of, for example, inert gas or air, and for control.

For fixation of the stationary axle 21, a swivel arm 40 is, for example, pivotably connected to the stand 23 on both sides.

The configuration of the roller allows a particularly advantageous mounting of an electromagnetic brake 41 within the casting roller 21 between the stationary axle 24 and the rotating casing 27.

The electromagnetic brake is able to calm turbulences of the metal bath, in particular, of the bath surface above the casting gap. The electromagnetic brake is advantageously arranged to be stationary on the stationary axle.

In the case of casting rollers 21 for wider strips, the cylindrical casing 27 between the two bearing rings 29, 29' can be provided with additional bearing rings for supporting the casing 27 on the stationary axle 24. These additional bearing rings are also connected to the casing 27 and are radially or axially supported on the axle 24 by ball or roller bearings.

Fig. 2 illustrates the casing 27 as a cylindrical body. The casing 27, without deviating from the inventive subject matter, can also have a slight crown bow or conical shape, and the like.

Fig. 3 shows the enlarged detail of a side of the casting roller 1. Here, the cooled casing is configured of two parts. The casing part 27' comprising the hot casing roll barrel is cooled by means of axially extending bores 39 carrying cooling

means. The other casing part 27 form together with a supporting element 29' a unitary part. Both casing parts 27, 27' are advantageously connected with each other by way of electron-beam welding. The casing part 27 or its supporting element 29' is rotatably supported on the stationary axle 24 by means of the bearing elements 31. The drive of the casting roller configured in this way is preferably effected by a brushless annular torque motor 36 arranged directly on the axle 24. The inlet and outlet means 30 for cooling medium, drilled into the axle 24, are also clearly shown. The other side of the casting roller, which is not shown, is configured correspondingly with or without a drive.

Claims

1. Strip casting machine comprised of two casting rollers (1, 2, 21) arranged parallel to each other, forming a casting gap (6) delimited on both sides by narrow lateral guides (5), and a stand (3, 23) supporting the casting rollers (1, 2, 21), wherein the casting rollers (1, 2, 21) are provided with cooled roll barrels forming the adjustable casting gap (6), and wherein bearing journals (8, 9) are provided for supporting the casting rollers (1, 2, 21) on the stand (3, 23),
characterized in that
the cooled roll barrel is comprised essentially of a cylindrical casing (27), which is supported on a stationary axle (24) fixedly connected to the stand (3, 23), by means of at least one supporting element, in particular, by supporting elements (29, 29') arranged on both sides, or by at least one supporting element (29, 29'), in particular protruding into the casing (27) on both sides.

2. Strip casting machine according to claim 1,
characterized in that
one supporting element (29') forms a part of the casing (27) and one supporting element (29) forms a part of the axle (24).

3. Strip casting machine according to claim 1,
characterized in that
the supporting elements (29, 29') are concentrical bearing rings connectable to the casing (27).

4. Strip casting machine according to claim 1,
characterized in that

the supporting elements (29, 29') form a part of the casing (27).

5. Strip casting machine according to at least one of the claims 1 through 4,
characterized in that
a first portion of the length of the supporting elements or the bearing rings (29, 29') projects into the casing and is provided with inlet and outlet bores (32) between the stationary axle (24) and the casing (27) for circulation of a cooling medium, and in that a second portion of the length of the supporting elements or the bearing rings (29, 29') projects from the casing (27) and is provided with bearing elements (31) and drive elements (37) for a rotational movement of the casing (27), provided with the supporting elements, or of the casing (27), fixedly connected to the bearing rings (29, 29'), on the stationary axle (24).

6. Strip casting machine according to at least one of the claims 1 through 5,
characterized in that
a crown gear (37) is connected to the bearing ring (29), which is in active connection with a toothing of a stationary drive (36).

7. Strip casting machine according to claim 6,
characterized in that
a drive gear (36) is flanged to the stationary axle (24).

8. Strip casting machine according to claim 6,
characterized in that
one or several annular torque motors drive the casing (27) by way of the bearing rings (29).

9. Strip casting machine according to at least one of the claims 1 through 8,
characterized in that
the bearing rings (29, 29') are preferably provided with radial bores (32) and grooves (33) for feeding the cooling medium from the stationary axle (24) into the casing (27).

10. Strip casting machine according to claim 9,
characterized in that
the stationary axle (24) is provided on both sides with axial bores (30') and with radial bores (34) aligned with grooves (33) of the bearing rings (29, 29').

11. Strip casting machine according to at least one of the claims 1 through 10,
characterized in that
the casing (27) is provided across its circumference with axially arranged bores (39) for a circulation of a cooling medium.

12. Strip casting machine according to at least one of the claims 1 through 11,
characterized in that
engaging keys (28) having a straining ring are provided between the bearing rings (29, 29') and the casing (27).

13. Strip casting machine according to at least one of the claims 1 through 12,
characterized in that
the stationary axle (24) is provided with inlet and outlet means (30) for a cooling medium, which simultaneously connect or disconnect inlet and outlet lines for cooling medium in the stand (23) when the

casting roller (21) is inserted into or lifted off the stand (23).

14. Strip casting machine according to at least one of the claims 1 through 13,
characterized in that
that the stationary axle (24) is provided on both sides of the casing (27) with a stop surface (12, 13) and a support surface (10, 11), respectively, and that stop surfaces and support surfaces are arranged on the stand for inserting the casting rollers from above.

15. Strip casting machine according to claim 14,
characterized in that
a locking element (40) for fixedly securing the stationary axle (24) is provided on both sides of the stand (23), respectively.

16. Strip casting machine according to at least one of the claims 1 through 15,
characterized in that
an electromagnetic brake (41) for the metal bath between the rollers is arranged between the rotating casing (27) and the stationary axle (24).

17. Strip casting machine according to claim 16,
characterized in that
the electromagnetic brake (41) within the casting roller (21) is arranged stationarily on the stationary axle (24).

18. Strip casting machine according to at least one of the claims 1 through 17,
characterized in that

the cylindrical casing (27) is supported on the stationary axle (24) by additional bearing rings between the two bearing rings (29, 29').

19. Strip casting machine according to at least one of the claims 1 through 18,
characterized in that
the drive (36) of the casting rollers (1, 2, 21) is effected by means of a motor, preferably a brushless annular torque motor, arranged on or at the axle.

20. Strip casting machine according to at least one of the claims 1 through 19,
characterized in that
the casing (27) is configured as a single piece or of multiple pieces.

21. Strip casting machine according to claim 20,
characterized in that
the connection of the casing pieces (27, 27') is preferably an electron-beam weld joint.

22. Strip casting machine according to at least one of the claims 1 through 21,
characterized in that
the casing (27) is built of two or more sleeves of different materials.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
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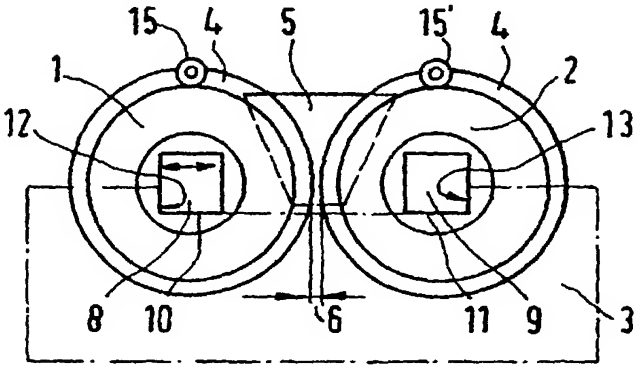
Veröffentlicht:
— *Mit internationalem Recherchenbericht.*

[Fortsetzung auf der nachsten Seite]

(54) Title: STRIP CASTING MACHINE COMPRISING TWO CASTING ROLLERS

(54) Bezeichnung: BANDGIESSMASCHINE MIT ZWEI GIESSROLLEN



(57) Abstract: The invention relates to strip casting machines comprised of two parallel casting rollers (1, 2) whose bearing journals (8, 9) are supported on a stand (3). Cooled roll barrels of the casting rollers (1, 2) and narrow lateral parts (5) delimit a casting gap (6). The aim of the invention is to obtain an optimal ratio between the width of the casting machine and the maximally castable strip width, to provide for a simple stand construction both for changing rollers as well as for exchanging narrow lateral parts, and to attain an improved protection against oxidation. To these ends, the invention provides that the cooled roll barrels are constructed as cylindrical casings (4). The casing (4) should be supported on a stationary axle, which is fixed on the stand (3), via the concentric support rings which project inside the casing (4) on both sides and which are connected to the same.

(57) Zusammenfassung: Bandgiessmaschinen bestehen aus zwei parallel angeordneten Giessrollen (1, 2) deren Lagerzapfen (8, 9) auf einem Ständer (3) abgestützt sind. Gekühlte Ballen der Giessrollen (1, 2) und Schmalseitenteile (5) begrenzen einen Giessspalt (6). Um ein optimales Verhältnis zwischen der Breite der Giessmaschine und der maximal giessbaren Bandbreite zu erreichen und um einen einfachen Ständeraufbau sowohl für den Rollenwechsel als auch für die Auswechslung von Schmalseitenteilen sowie einen besseren Oxydationsschutz zu erhalten, wird vorgeschlagen, die gekühlten Ballen als zylindrische Mäntel (4) auszubilden. Über beidseits in den Mantel (4) hineinragende und mit diesem verbundene konzentrische Stützringe soll der Mantel (4) auf einer am Ständer (3) fixierten stillstehenden Achse abgestützt werden.

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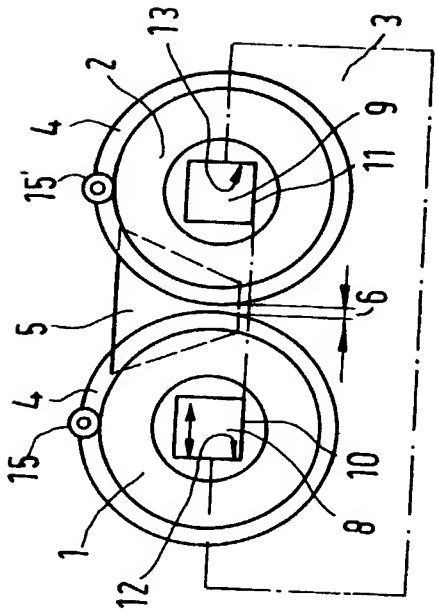
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FIG.1

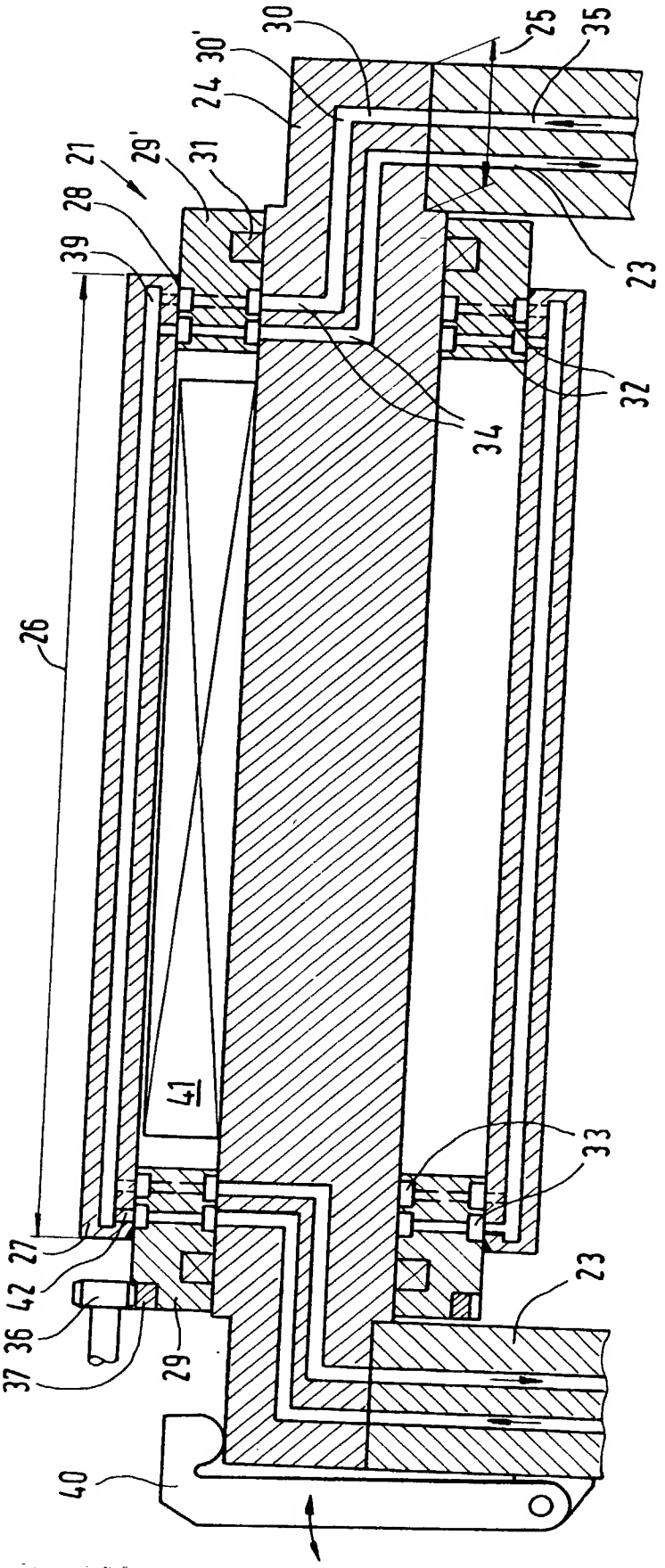
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FIG.2

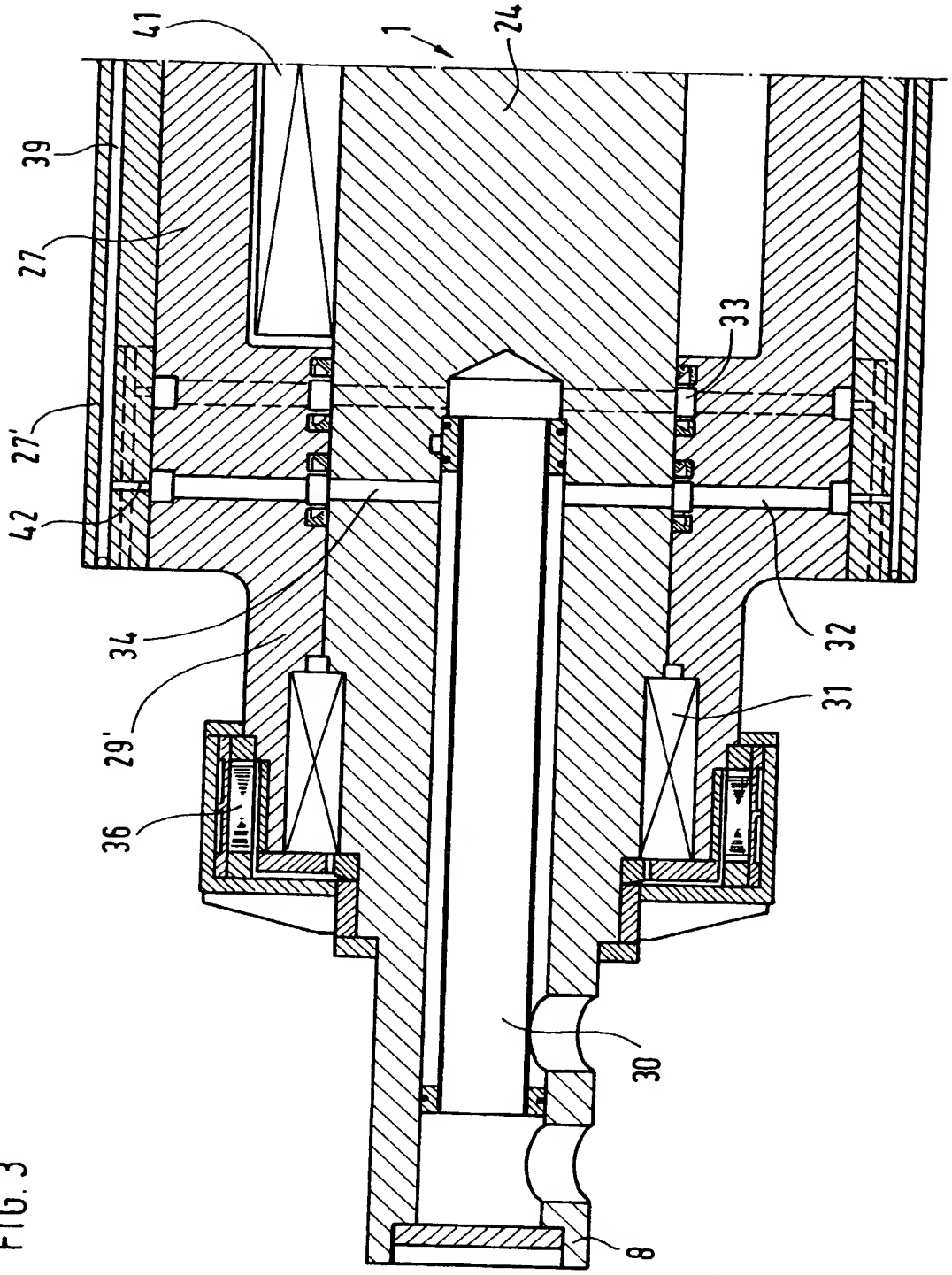

FIG. 3

COMBINED DECLARATION FOR PARENT APPLICATION AND POWER OF ATTORNEY *(includes reference to PCT International Applications)*	Attorney's Docket No. **HM-469**

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **STRIP CASTING MACHINE COMPRISING TWO CASTING ROLLERS**

the specification of which (check only one item below):

[ ] is attached hereto.

[ ] was filed as United States application
Serial No. _____
on _____,
and was amended
on _____(if applicable).

[X] was filed as PCT international application
Number **PCT/EP00/07961**
on **August 16, 2000**,
and was amended under PCT Article 19
on _____(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY *(if PCT, indicate PCT)*	APPLICATION NUMBER	DATE OF FILING *(day, month, year)*	PRIORITY CLAIMED UNDER 35 USC 119
SWITZERLAND	**1999 1528/99**	**20 August 1999**	[X] YES [ ] NO
			[ ] YES [ ] NO

PTO-1391 (REV. 10-83) U.S. DEPARTMENT OF COMMERCE - Patent and Trademark Office

10019738 .060302

Combined Declaration For Parent Application and Power of Attorney (Continued) *(includes Reference to PCT International Applications)*	Docket No. HM-469

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of the application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty of disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application(s) and the national or PCT internation filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (CHECK ONE)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NO.		

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(List name and registration number)*

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Combined Declaration For Parent Application and Power of Attorney (Continued) *(includes Reference to PCT International Applications)*				Docket No. HM-469
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE OF INVENTOR 201	*SIGNATURE OF INVENTOR 202*	*SIGNATURE OF INVENTOR 203*
Hans Stenbol	H. Marti Heinrich Marti	Jacques Barbé
DATE 25-04-02	*DATE* CH-8127 Forch May 9, 2002	*DATE* CH-8127 Forch May 9, 2002

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